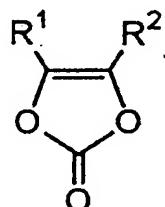


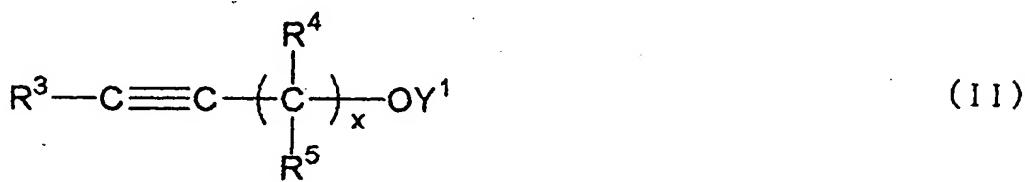
CLAIMS

1. A non-aqueous electrolytic solution comprising  
an electrolyte salt in a non-aqueous solvent for a lithium  
5 secondary battery, wherein the non-aqueous electrolytic solution further contains a vinylene carbonate compound represented by the formula (I) in an amount of 0.01 to 10 wt.%, and at least one alkyne compound represented by the formula (II), (III), (IV), (V), (VI), or (VII) in  
10 an amount of 0.01 to 10 wt.%:



(I)

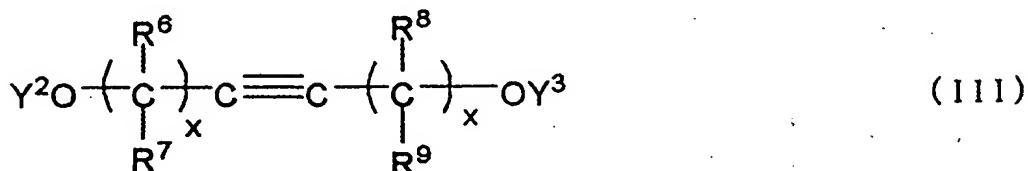
in which each of R<sup>1</sup> and R<sup>2</sup> independently is a hydrogen atom or an alkyl group having 1 to 4 carbon atoms;



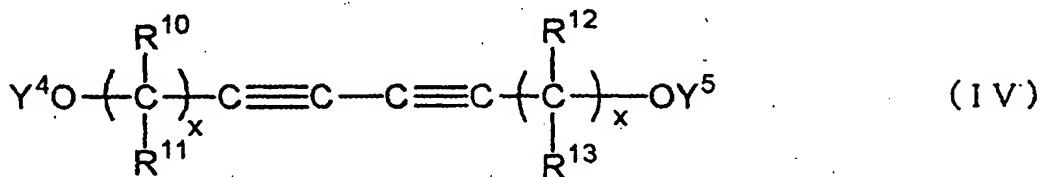
(II)

15 in which each of R<sup>3</sup> to R<sup>5</sup> independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms, or R<sup>4</sup> and R<sup>5</sup> are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms; x is 1 or 2; and Y1  
20 is -COOR<sup>20</sup>, -COR<sup>20</sup>, or -SO<sub>2</sub>R<sup>20</sup>, wherein R<sup>20</sup> is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a

cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms;

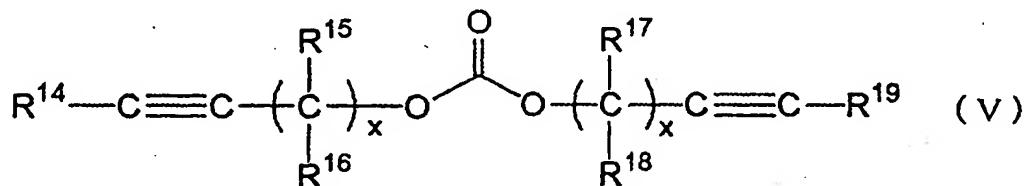


in which each of R<sup>6</sup> to R<sup>9</sup> independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms, or R<sup>6</sup> and R<sup>7</sup> or R<sup>8</sup> and R<sup>9</sup> are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms; x is 1 or 2; Y<sup>2</sup> 5 is -COOR<sup>21</sup>, -COR<sup>21</sup>, or -SO<sub>2</sub>R<sup>21</sup>, wherein R<sup>21</sup> is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms; and Y<sup>3</sup> 10 is -COOR<sup>22</sup>, -COR<sup>22</sup>, or -SO<sub>2</sub>R<sup>22</sup>, wherein R<sup>22</sup> is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms; 15

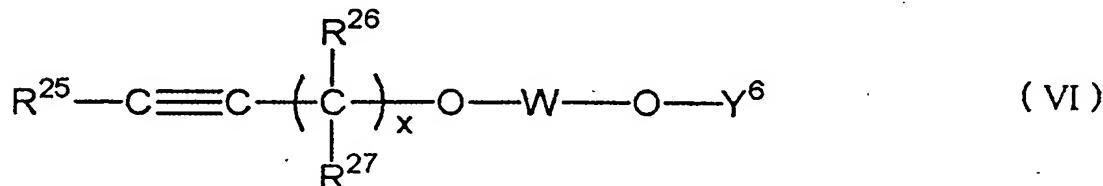


in which each of R<sup>10</sup> to R<sup>13</sup> independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms, or R<sup>10</sup> and R<sup>11</sup> or R<sup>12</sup> 20

and R<sup>13</sup> are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms; x is 1 or 2; Y<sup>4</sup> is -COOR<sup>23</sup>, -COR<sup>23</sup>, or -SO<sub>2</sub>R<sup>23</sup>, wherein R<sup>23</sup> is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a  
5 cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms; and Y<sup>5</sup> is -COOR<sup>24</sup>, -COR<sup>24</sup>, or -SO<sub>2</sub>R<sup>24</sup>, wherein R<sup>24</sup> is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl  
10 group having 6 to 12 carbon atoms;

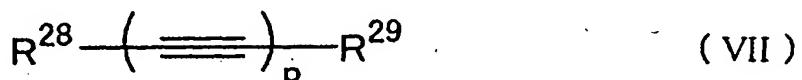


in which each of R<sup>14</sup> to R<sup>19</sup> independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl  
15 group having 6 to 12 carbon atoms, or R<sup>15</sup> and R<sup>16</sup> or R<sup>17</sup> and R<sup>18</sup> are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms; and x is 1 or 2;



in which each of R<sup>25</sup> to R<sup>27</sup> independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, an aryl group having 6 to 12 carbon atoms, or an aralkyl group  
20

having 7 to 12 carbon atoms, or R<sup>26</sup> and R<sup>27</sup> are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms; x is 1 or 2; W is sulfinyl, sulfonyl, or oxalyl; and Y<sup>6</sup> is an alkyl group having 1 to 12 carbon atoms, an alkenyl group having 2 to 12 carbon atoms, an alkynyl group having 2 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, an aryl group having 6 to 12 carbon atoms, or an aralkyl group having 7 to 12 carbon atoms;



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in which R<sup>28</sup> is an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms; R<sup>29</sup> is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms; and p is 1 or 2.

2. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution contains 20 the vinylene carbonate compound in an amount of 0.05 to 5 wt.%.

3. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution contains 25 the vinylene carbonate compound in an amount of 0.1 to 3 wt.%.

4. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution contains the alkyne compound in an amount of 0.05 to 5 wt.%.

5 5. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution contains the alkyne compound in an amount of 0.1 to 3 wt.%.

10 6. The non-aqueous electrolytic solution of claim 1, wherein the vinylene carbonate compound is vinylene carbonate.

15 7. The non-aqueous electrolytic solution of claim 1, wherein the alkyne compound is 2-propynyl methyl carbonate, 2-propynyl methanesulfonate, 2-butynylene bis(methyl carbonate), 2-butynylene bis(methanesulfonate), 2,4-hexadiynylene bis(methyl carbonate), di(2-propynyl) carbonate, di(2-propynyl) sulfite, di(2-propynyl) oxalate, phenylacetylene, ethyl 2-propynyl oxalate, 2-propynyl formate, 2-butynylene diformate or 2,4-hexadiynylene diformate.

8. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution further contains an aromatic compound in an amount of 0.1 to 5 wt.%, said aromatic compound being selected from the 5 group consisting of cyclohexylbenzene, a fluorocyclohexylbenzene compound, biphenyl, terphenyl, diphenyl ether, 2-fluorophenyl phenyl ether, 4-fluorophenyl phenyl ether, fluorobenzene, difluorobenzene, 2-fluorobiphenyl, 4-fluorobiphenyl, 2,4-difluoroanisole, tert-butylbenzene, 10 1,3-di-tert-butylbenzene, 1-fluoro-4-tert-butylbenzene, tert-pentylbenzene, tert-butyl biphenyl, tert-pentyl biphenyl, a partially hydrogenated o-terphenyl, a partially hydrogenated m-terphenyl and a partially hydrogenated p-terphenyl.

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9. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution further contains a mixture having a weight ratio of 50:50 to 10:90 in a total amount of 0.1 to 5 wt.%, said mixture 20 being selected from the group consisting of a mixture of biphenyl and cyclohexylbenzene, a mixture of cyclohexylbenzene and tert-butylbenzene, a mixture of cyclohexylbenzene and tert-pentylbenzene, a mixture of biphenyl and fluorobenzene, a mixture of cyclohexylbenzene and fluoro- 25 benzene, a mixture of 2,4-difluoroanisole and cyclohexylbenzene, a mixture of cyclohexylbenzené and 1-fluoro-4-tert-butylbenzene, a mixture of cyclohexylbenzene and a fluorocyclohexylbenzene compound, a mixture of a fluorocyclohexylbenzene compound and fluorobenzene, and a mixture of 30 2,4-difluoroanisole and a fluorocyclohexylbenzene compound.

10. A lithium secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolytic solution, wherein the positive electrode comprises lithium mixed oxide, wherein the negative electrode comprises a material capable of absorbing and releasing lithium, and wherein the non-aqueous electrolytic solution is the solution defined in claim 1.

11. A lithium secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolytic solution, wherein the positive electrode is a positive electrode composition layer having a density in the range of 3.2 to 4.0 g/cm<sup>3</sup> provided on aluminum foil, said positive electrode layer composition layer comprising lithium mixed oxide, and wherein the non-aqueous electrolytic solution is the solution defined in claim 1.

12. A lithium secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolytic solution, wherein the negative electrode comprises a negative electrode composition layer having a density in the range of 1.3 to 2.0 g/cm<sup>3</sup> provided on copper foil, said negative electrode layer composition layer comprising a material capable of absorbing and releasing lithium, and wherein the non-aqueous electrolytic solution is the solution defined in claim 1.

13. A lithium secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolytic solution, wherein the positive electrode comprises a positive electrode composition layer having a density in the range of 3.2 to 4.0 g/cm<sup>3</sup> provided on aluminum foil, said positive electrode layer composition layer comprising lithium mixed oxide, wherein the negative electrode comprises a negative electrode composition layer having a density in the range of 1.3 to 2.0 g/cm<sup>3</sup> provided on copper foil, said negative electrode layer composition layer comprising a material capable of absorbing and releasing lithium, and wherein the non-aqueous electrolytic solution is the solution defined in claim 1.